

Earned Value Management Past, Present & Future

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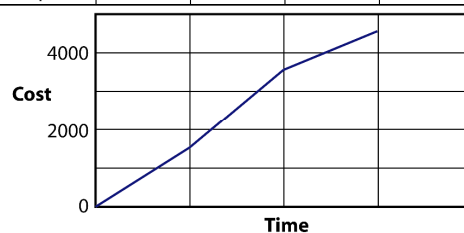


What is Earned Value?

Write Specification

Month	1	2	3	4
Outline	█			
Write		█	█	
Review & Accept			█	

Outline	1000			
Write	500	2000	500	
Review & Accept			500	



Developing a time phased budget to 'write a specification'.

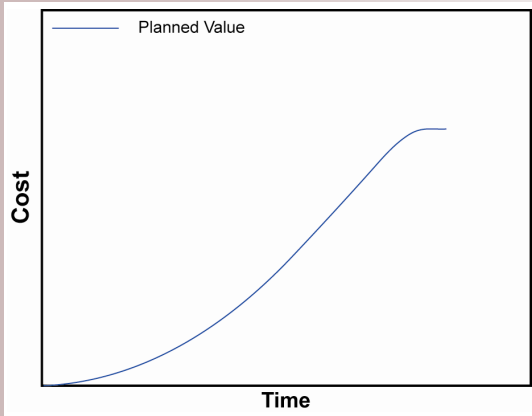
Outline = 1000

Write = 3000

R & A = 500



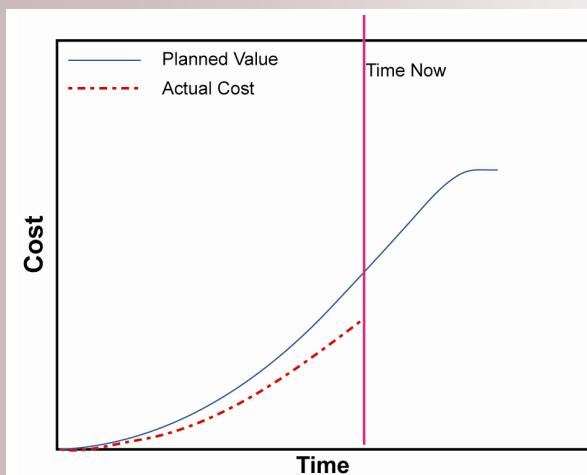
What is Earned Value?



- The foundation is a time phased budget

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What is Earned Value?

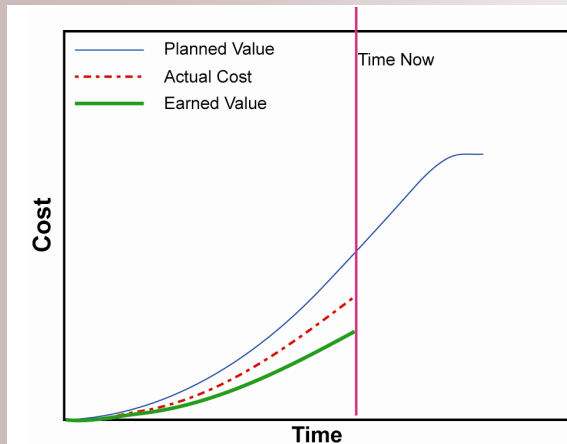


- Measuring actual cost adds little extra value

Is this project profitable or behind schedule?

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What is Earned Value?

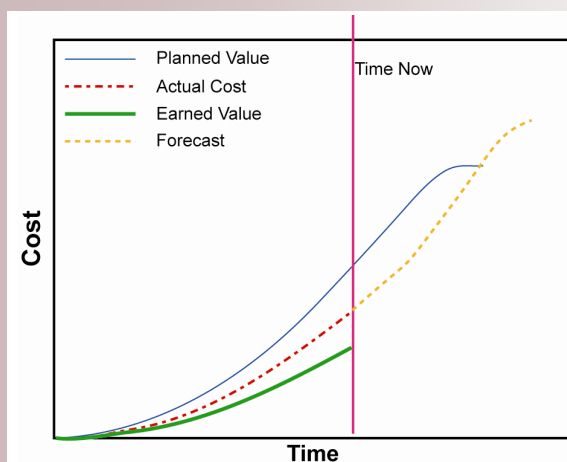


- Earned value highlights the real situation

The project is losing money and behind schedule!

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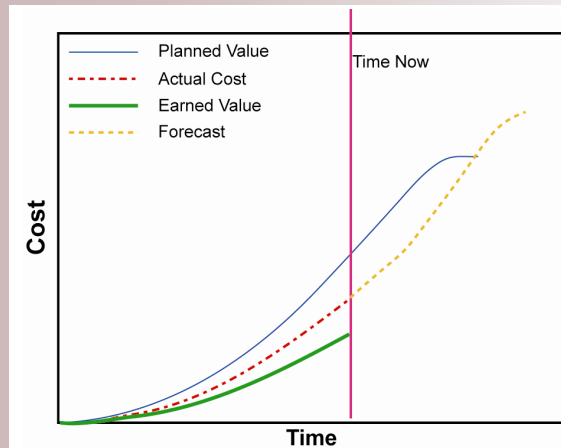
What is Earned Value?



- Calculations can also project the 'cost to complete' and the 'time to complete'

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What is Earned Value?



- All of this needs calculation using defined formulae (but not today)

For more on earned value basics see:

<http://www.mosaicprojects.com.au/Techniques.html#EarnedValue>

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What is Earned Value?

- EVM provides the framework for an effective project management and governance system
- It is flexible in the **how** of its structure and implementation (work packages)
- It is rigorous in the **what** of measurement, visibility and accountability

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The Past

- EVM is 50 years old!
 - Modern 'Earned Value' standards have developed from the C/SCSC systems promulgated by the US Military
 - Cost Schedule Planning and Control Specification (CSPCS or 'C-Spec') was published in 1966
 - There were 26 "specifications" that a contractor's system had to meet



The Past

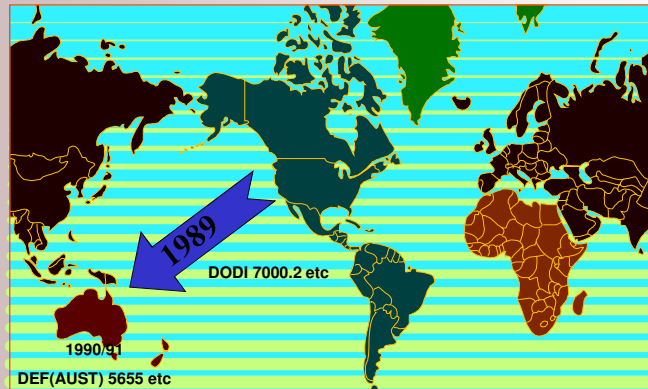
- EVM is 50 years old!
 - The 35 criteria of C/SCSC were first published in 1971 as DoDI 7000.2
 - Current EIA-748 contains 32 of these original 35 criteria as Guidelines
 - There is little change from the original

For more on the history of project management see: <http://www.mosaicprojects.com.au/PM-History.html>



Earned Value Management – Past, Present & Future

The Past



- EVM spread slowly to Aust., UK, Sweden, etc.....

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The Past

- Australian Developments
 - 1990/1991 Def(AUST)
5655 / 5657 / 5658 / 5664
 - AS 4817 2003 & 2006

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The Present

- Moves away from prescriptive 'criteria' towards a pragmatic management approach
- AS 4817 2003 and 2006
- PMI *Practice Standard for Earned Value Management*
- UK standards (APM and others)
- ISO 21511 (in development)



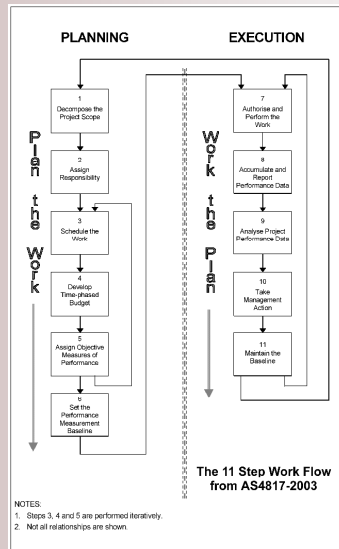
AS 4817

- Earned Value Management
 - Basic requirements are to:
 - Define what work, by whom & when
 - Assign realistic resources
 - Implement objective measurement of progress
 - Report significant deviations
 - Forecast completion dates/costs
 - Plan/implement corrective actions
 - Manage changes



Earned Value Management – Past, Present & Future

AS 4817



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AS 4817

- Plan the project:
 - Step 1 – Decompose the Project Scope
 - Step 2 – Assign Responsibility
 - Step 3 – Schedule the Work
 - Step 4 – Develop Time-Phased Budget
 - Step 5 – Assign Objective Measures of Performance
 - Step 6 – Set the Performance Measurement Baseline

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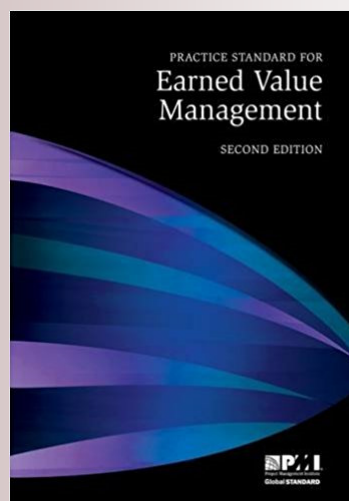
Earned Value Management – Past, Present & Future

AS 4817

- Manage the project:
 - Step 7 – Authorise and Perform the Work
 - Step 8 – Accumulate and Report Performance Data
 - Step 9 – Analyse Project Performance Data
 - Step 10 – Management Action
 - Step 11 – Maintain the Baseline

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PMI Practice Standard



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Earned Value Management – Past, Present & Future

ISO 21511

1 Scope	5 Earned Value Management process description
2 Normative References	5.1 STEP 1: Decompose the project scope
3 Terms and definitions, abbreviated terms	5.2 STEP 2: Assign Responsibility
3.1 Terms and definitions	5.3 STEP 3: Schedule the work
3.2 Abbreviated terms	5.4 STEP 4: Develop time-phased budget
4 Overview of Earned Value Management	5.5 STEP 5: Assign objective measures of performance
4.1 Role and Benefits of Earned Value Management	5.6 STEP 6: Set the performance measurement baseline
4.2 Earned Value management	5.7 STEP 7: Authorize and perform the work baseline
4.3 Performance management	5.8 STEP 8: Accumulate and report performance data
4.4 Guidelines for an earned value management system	5.9 STEP 9: Analyse project performance data
4.5 Earned value management planning	5.10 STEP 10: Take management action
4.6 Using Earned Value performance measurements	5.11 STEP 11: Maintain the baseline
	6 Earned Value Management System Review
	6.1 Integrated Baseline Review
	6.2 Demonstration review
	6.3 Surveillance

Annex A (informative) Cost and performance measurement analysis using earned value management data
Annex B (informative) Schedule Analysis using earned value management data (Earned Schedule)
Annex C (informative) Integrating other project management processes with earned value management
Annex D (informative) Bibliography



EV Management

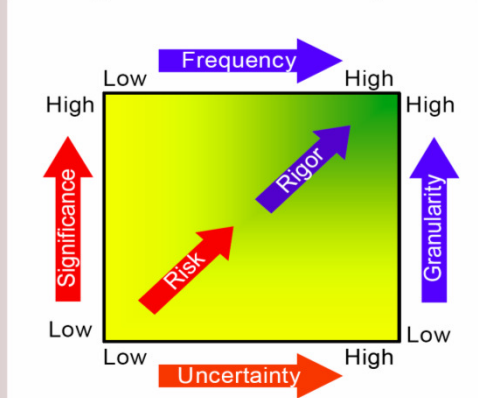
- **Control has three components:**
 - Knowing what the 'in control' state is
 - Measuring the variance from that state
 - Acting to remove the variance
- Requires a practical tool set



EV Management

- Balance risk and rigour
- Adequate detail
- Sensible frequency

EVM Rigor as a Function of Project Risk



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Analysing Performance Data

Performance Measures		Schedule		
		SV > 0 & SPI > 1.0	SV = 0 & SPI = 1.0	SV < 0 & SPI < 1.0
Cost	CV > 0 & CPI > 1.0	Ahead of Schedule Under Budget	On Schedule Under Budget	Behind Schedule Under Budget
	CV = 0 & CPI = 1.0	Ahead of Schedule On Budget	On Schedule On Budget	Behind Schedule On Budget
	CV < 0 & CPI < 1.0	Ahead of Schedule Over Budget	On Schedule Over Budget	Behind Schedule Over Budget

- The responsible manager needs to explain
 - What caused the variance
 - What is being done about the variance

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The Present

- EV is the 'gold standard' for effective project controls
 - Integrates scope cost and time
 - Overtly includes risk and contingency
 - Predicts cost outcomes accurately*
 - With Earned Schedule added, predicts time outcomes accurately*
- Has been around for 50 years

*EV and ES predictions are consistently more accurate than other options, see: Why CPM is wildly optimistic –

http://www.mosaicprojects.com.au/Resources_Papers_117.html



The Present

- **BUT no one is really using it!**
 - Mandated in Defence (to a degree)
 - Mandated in USA government projects
- Why isn't everyone else using it??
 - Don't like discipline and control?
 - Too hard to implement??
 - Domain of 'high priced' *experts*???



The Present

- Earned Value is not alone
 - Most projects don't use dynamic scheduling
 - Cost control is typically after the event (too late)
 - Project controls staff (where they exist)
 - Are largely ignored when decisions are being made
 - Are focused on forensic analysis and claims

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The Present

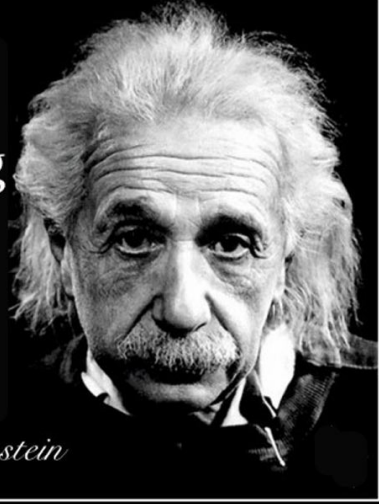
- A high percentage of projects:
 - Finish late
 - Finish over budget
 - Fail to deliver on scope
 - Benefits are not realised
- What needs to change?

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The Present

Insanity:
doing the same thing
over and over again
and expecting
different results.

- Albert Einstein



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The Future

- Big data and integrated systems
- ***Project controls need to shift from an 'add-on' process external to the main project information flows to a fully integrated part of the project information system.....***

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The Future

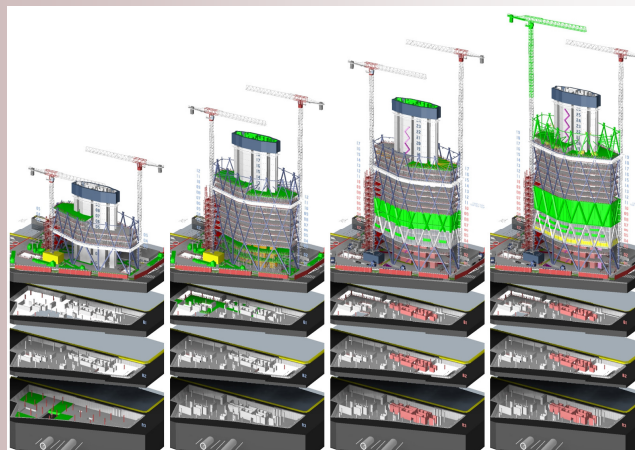
- The future is here – BIM* exists and is spreading expect similar systems to emerge in your industry!
 - 3D BIM = 3 dimensional model X –Y – Z axis (length, breadth, height – ie, scope)
 - 4D incorporates time
 - 5D incorporates cost
- EV integrates scope, cost and time!

*BIM = Building Information Modelling

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The Future

- 4D BIM produces very useful insights:

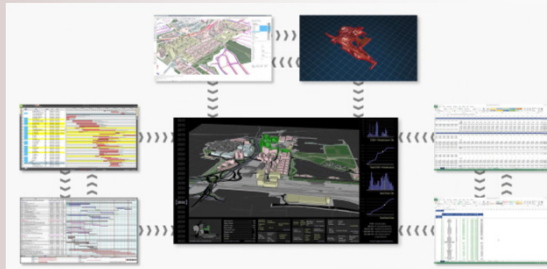


Source: <http://www.freeform3d.co.uk>

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The Future

- Current capabilities include:
 - The ability to import schedule timings to animate the building of the model, and to feedback information such as the identification of clashes in the use of work space, cash flows (5D), etc.

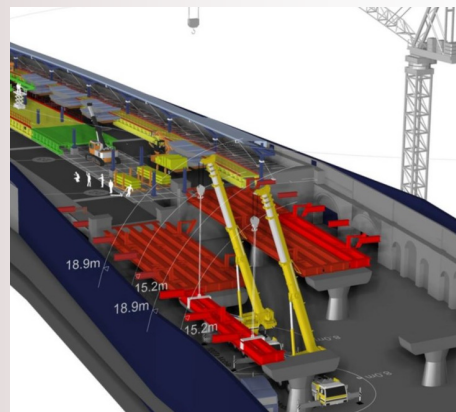


Source: <http://www.freeform3d.co.uk>

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The Future

- The space occupied by temporary works and various pieces of equipment can be defined and clashes with permanent works identified over time



Source: <http://www.freeform3d.co.uk>

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The Future

- Virtual reality adds to this to include the ability for a person to move around within the virtual model
 - As planned
 - As built



For more on these ideas in the context of project controls and scheduling see:
http://www.mosaicprojects.com.au/PDF_Papers/P200_Projects_controls_using_integrated_data.pdf

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The Future

- Opportunities and possibilities for controls in a fully integrated 5D BIM environment:
 - To plan the work the ‘planning team’ put on their virtual reality headsets and literally ‘walk’ onto the site. As they start to locate temporary works and begin the building process the model is tracking the use of resources and physical space in real time

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The Future

- Opportunities and possibilities for controls in a fully integrated 5D BIM environment:
 - Decisions can be made to adjust the size of resource crews and the flow of work can be optimised to balance the competing objectives of cost efficiency, time efficiency and resource optimisation. Different scenarios can be stored, replayed and edited
 - The ultimate ‘what-if’ experience.



The Future

- When complete, a fully integrated 5D BIM environment allows us to know:
 - What work is being done where, when and by who
 - The specification for the elements being used
 - The planned cost of the work over time
 - This is the project’s PMB



The Future

- 5D BIM also allows the collection of EV and AC within the model
 - BIM is already used via PDAs to provide information on 'what' to build (replacing paper drawings and specifications) and 'where' to build it
 - Enhance this to include 'when' information for both current work and the intended sequence of future work and you have the start of a proactive 'controls' function



The Future

- 5D BIM also allows the collection of EV and AC within the model
 - Automatically track progress, as a job is marked 'complete' in the BIM model (locking it to prevent unnecessary changes) the integrated schedule is updated and the EV is automatically recorded in real time
 - AC can be inferred from resource usage and updated from the accounts system later



The Future

- This is not 'science fiction' London's Cross Rail project is already using 4D BIM to detect and avoid clashes in the use of working space and to record the status of work
- Add cost (the 5th D) and real-time EVM becomes feasible



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The Future

- Integrated 5D BIM will require progressive planning and collaboration:
 - As the overall BIM model is developed the planners work with management to set out an overall approach (strategy) for the work and set the time budgets for the project
 - As the various suppliers are identified their work is incorporated within the schedule in more detail

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The Future

- Integrated 5D BIM will require progressive planning and collaboration:
 - The short term detailed planning of precisely who does what, where and when is done on-site with the work crews based on actual production rates and real-time status information

For more on 'Schedule Density see:

http://www.mosaicprojects.com.au/WhitePapers/WP1016_Schedule_Density.pdf



The Future

- When inevitable problems occur, the project management team have the ideal tool to work through solutions and determine the optimum way forward, as soon as the new schedule is agreed, the BIM model already holds the information
- **But facilitating this type of approach will need a very different contractual approach!**



The Future

- Data is not management information
 - The challenge for controls professionals will be to draw meaning from the mass of data
 - **Controls professionals will need to be able to extract meaningful information quickly and make it available to management for decisions and action**
 - But with accurate information available in real-time who needs 'monthly reports'?



Conclusions

- This presentation has only 'scratched the surface' of the potential changes being opened up by new technologies
- In a few years the ability to use EVM software is likely to be as out-of-date as the ability to manually draw and calculate a CPM schedule is today – if you want to stay relevant you will need to start developing completely new skill sets



Conclusions

- **The biggest challenge** – getting project controls professionals embedded in the development of BIM and the other emerging technologies so their development incorporates useful controls processes and functions

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Conclusions

- **The other big challenge** – changing attitudes
 - Collaboration not confrontation
 - Progressive, dynamic management of the project time and cost – the nirvana for EV
 - Problem solving rather than blame placing
 - Generating useful information and advice from masses of data – and having the advice listened to by management

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Conclusions

- **The other big challenge.** Sorting out the ethical and legal issues around ownership, traceability and liability for each data element in an integrated BIM model accessed by many people
- **The future is going to be exciting, but only for those who are willing to embrace the opportunities**

For more on traceability see

<https://mosaicprojects.wordpress.com/2016/12/13/the-yin-and-yang-of-integrated-data-systems/>



Conclusions

If you don't like change you are going to like irrelevance less.

Gen. Eric Shinseki (US Army retired)



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Questions??

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